l'étude des grands phénomènes de la physique du globe. On peut reconnaître, dès à présent, que le nombre des stations nécessaires pour établir la loi de continuité est insuffisant, surtout dans toute l'étendue de l'Asie.

June 5, 1851.

The EARL OF ROSSE, President, in the Chair.

The Annual Meeting for the election of Fellows was held this day.

The Statutes for the election of Fellows having been read, Dr. Roget and Mr. Spence were, with the consent of the Society, appointed Scrutators.

The votes of the Fellows present having been collected, the following gentlemen were declared duly elected:—

Charles Cardale Babington, Esq.
Thomas Snow Beck, M.D.
Charles James Fox Bunbury, Esq.
George T. Doo, Esq.
Edward B. Eastwick, Esq.
Captain Charles M. Elliot.
Captain Robert FitzRoy, R.N.
John Russell Hind, Esq.
Augustus William Hofmann, Esq.
Thomas Henry Huxley, Esq.
William Edmond Logan, Esq.
James Paget, Esq.
George Gabriel Stokes, Esq.
William Thomson, Esq.
Augustus V. Waller, M.D.

The Society then adjourned to the 19th of June.

June 19, 1851.

The EARL OF ROSSE, President, in the Chair.

The following gentlemen were admitted into the Society:—

Charles Cardale Babington, Esq.
Thomas Snow Beck, M.D.
Edward B. Eastwick, Esq.
Captain Charles M. Elliot.
Captain Robert Fitz-Roy, R.N.
Thomas Henry Huxley, Esq.
William Edmond Logan, Esq.
George Gabriel Stokes, Esq.

His Grace the Duke of Argyll was balloted for, and elected a Fellow of the Society.

The following papers were then read:—

1. "Researches in Symbolical Physics. On the Translation of a Directed Magnitude as Symbolised by a Product. The Principles of Statics established symbolically." By the Rev. M. O'Brien, M.A., late Fellow of Caius College, Cambridge, and Professor of Natural Philosophy and Astronomy in King's College, London. Communicated by W. A. Miller, M.D., F.R.S. &c. Received April 10, 1851.

In this communication the author (starting from the well-known

theorem, that two sides of a triangle are equivalent to the third, when *direction*, as well as magnitude, is taken into account) proposes an elementary step in symbolization which consists in representing the *Translation of a Directed Magnitude* by a *Product*. Any magnitude which is drawn or points in a particular direction, such as a force, a velocity, a displacement, or any of those geometrical or physical quantities which we exhibit on paper by *arrows*, he calls a *directed magnitude*. By the *translation* of such a magnitude he means the removal of it from one position in space to another *without change of direction*.

U representing any directed magnitude and u any distance, the translation of U to any parallel position in space, in such wise that every point or element of U is caused to describe the distance u, is termed the *translation of* U *along* u.

This translation consists generally of two distinct changes, one the *lateral* shifting of the line of direction of U, and the other the motion of U *along* its line of direction. The former is called the *transverse effect*, the latter the *longitudinal effect* of the translation of U along u.

Both these effects are shown to be *products* of U and u; the transverse effect is represented by uU, and the longitudinal by u.U, inserting a dot between the factors in the latter for the sake of distinction.

The author then goes on to apply the principles established to the proof of the *Parallelogram of Forces*, and the determination of the effect of any set of forces on a rigid body. In doing this a remarkable symbolization of the *point of application*, as well as the direction and magnitude of a force, is obtained, namely, that the expression $(1+u)$U represents a force U acting at a distance u from the origin.

The principles of statics are deduced with remarkable facility from the symbolical representation of the translation of a force along a given distance.

2. "On an Air-Engine." By James Prescott Joule, F.R.S. &c. Received May 13, 1851.

The air-engine described in this paper consists of a pump by which air is compressed into a heated receiver; and a cylinder, through which the air passes again into the atmosphere. The difference between the work evolved by the cylinder and that absorbed by the pump, constitutes the work evolved by the engine on the whole. Two tables are given; the first of which contains the pressure, temperature and work absorbed, for various stages of the compression of a given volume of air. The second table gives the theoretical duty of the air-engine described, worked at various pressures and temperatures. The temperature recommended to be adopted in practice is as little below the red heat as possible, which would involve the consumption of only about one-third the amount of fuel consumed by the best steam-engines at present constructed.